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International Diversity and Student Engagement in Graduate Engineering Research Groups

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Abstract

The purpose of this study was to explore student engagement by student nationality in U.S. engineering graduate programs. An online survey was developed and administered to four universities across the United States during fall 2010, with responses from 640 engineering PhD students from 5 international regions. Five constructs were found to be both statistically and practically significant relative to students' satisfaction with their graduate experience, including: expectations, international diversity, learning and development, project ownership, and organization. Univariate ANOVA and post hoc pairwise comparisons highlight differences in specific nationality groups.

Keywords: Student engagement; Graduate Engineering Research; international diversity; graduate experience; constructs

1. Introduction

In the United States, an average of one out of every two graduate students will not complete their degree; an attrition rate that has not changed for more than half a century (Berelson, 1960; Bowen & Rudenstine, 1992; Nerad & Cerny, 1993). Doctoral education provides the labor force not only for top positions within the professoriate, but also in scientific laboratories and research facilities, educational administration, and business and industry (Haworth, 1996). This attrition rate has prompted increasingly prevalent research on retaining students in graduate programs over the last 30 years (Bair & Haworth, 1999).

This research has focused on disciplinary differences (Gardner, 2009; Golde, 2005; Nettles & Millett, 2006), the role of the faculty advisor and mentoring (Bell-Ellison & Dedrick, 2008; Frehill, Lain, Jacquez, Luces, &

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Ketcham, 2007; Lee, 2008; Malfroy, 2005), stages of student development (Ampaw & Jaeger, in press; Golde, 1998; Lovitts, 2008), socialization to the community (Boden, Borrego, & Newswander, 2011; Lovitts, 1996; Pilbeam & Denyer, 2009; Weidman & Stein, 2003a, 2003b), and demographic considerations (Cuny & Aspray, 2002; McAfee & Ferguson, 2006), among others.

Researchers in the field of graduate education have used several lenses to explore and attempt to measure the graduate student experience, including: socialization to the discipline, the role of the supervisor, the organization of the department, and learning in the research group. While not directed at engineering students or the research group directly, we find these lenses instrumental in exploring their influence on student engagement.

Two other relevant bodies of literature pertain to the relationship between the students and their faculty advisors (Deem & Brehony, 2000; Grevholm, Persson, & Wall, 2005; Lee, 2008; Malfroy, 2005; Pearson & Brew, 2002) and the climate in graduate engineering programs (Louis, Holdsworth, Anderson, & Campbell, 2007). The emphasis on the role of the advisor is often focused on individual students, and not on the supervision of research groups which are more common in the engineering and the natural sciences. Another means of measuring the graduate student experience is to examine the climate in engineering graduate programs, which may dictate student – faculty interactions and peer interactions among graduate students. For example, Litzler *et al* (2005) investigated the climate for graduate students in science and engineering departments and found that the degree of competition is highly and negatively correlated to degree progress.

Central to the issue of retention in engineering programs is student engagement in the learning experience. Research on undergraduate education has shown that satisfaction with student experience, both academic, social and cultural, is correlated with engagement and ultimately retention in degree programs (G. D. Kuh, J, Cruce, Shoup, & Gonyea, 2006). Another study by Greg (1972) showed that the factors affecting satisfaction run parallel to those affecting intention to complete the degree. While previous studies have paved the way for future research, applied research in graduate student engagement is limited, and may fall short of maximizing the potential use of previous retention and satisfaction models to capture the full complexity of the graduate student experience. Previous models have focused more on individual program elements, such as coursework and qualifying exams, rather than the unique experiences in a research group environment. In addition large quantitative studies lack the depth found in the qualitative work, while qualitative studies are unable to account for interactions between and among the variables of interest. Bridging the findings from the qualitative studies, as well as the research in undergraduate student engagement, to examine a combination of factors, along with a large quantitative data set, may help further explain engagement in graduate programs and confirm findings from previous research. We view this as an opportunity to develop a better understanding of student satisfaction with their graduate research group experience, with the aim of increasing engagement and ultimately reducing attrition from graduate engineering programs. In this study we consider the engineering specific context of research group, and analyze differences in satisfaction constructs across and internationally diverse population.

The aim of this quantitative study was to develop a fuller understanding of student satisfaction, and ultimately engagement, in graduate engineering research groups at U.S universities. Specifically, we were interested in a defining feature of graduate engineering research groups: a highly internationally diverse population. To this end we addressed the following research question: How do key aspects of student satisfaction with the research group experience vary for students from different nationalities?

2. Modeling Student Engagement

Several theoretical models for undergraduate student outcomes have been developed in the literature (e.g.

Astin, 1993; Koljatic & Kuh, 2001; Pascarella, 1985; Pascarella & Terenzini, 2005; Umbach & Wawrzynski, 2005) in essence, these models argue that student outcomes such as engagement are affected by the human, social and cultural capital students bring to college, as well as their experiences on campus and aspects of the institution such as size and selectivity. Chickering and Gamson's seven principles for good practice in undergraduate education are likely the best-known set of student engagement indicators (George D. Kuh, Kinzie, Schuh, & Whitt, 2005). These seven principles which are proposed to facilitate student engagement include: student faculty contact, cooperation among students, active learning, prompt feedback, time on task, high expectations, and respect for diverse talents and ways of learning (Chickering & Gamson, 1987). Similar to the principles for good practice, the National Survey of Student Engagement identifies five benchmarks of effective educational practice which include: level of academic challenge, active and collaborative learning, student interaction with faculty members, enriching educational experiences, and supportive campus environment (George D Kuh, 2004; G. D. Kuh, Hayek, J. C., Carini, R.M., Ouimet, J. A., Gonyea, R. M., and Kennedy, J., 2001).

In one review, undergraduate student satisfaction is conceived to represent loyalty toward an institution and is reported to be highly correlated with student engagement, persistence, and academic performance (G. D. Kuh, et al., 2006). Additionally, student satisfaction with postsecondary education appears to be more influenced by the college environment and less influenced by students' entering characteristics (G. D. Kuh, et al., 2006). Mann (2001) suggested that a focus on experiences of alienation and engagement could provide a broader and more contextualized view on the student learning experience. She focused on the case of alienation, offering seven types of alienation that students may experience, including: self preservation, loss of ownership of learning, and the student as outsider. Case (2007) began building on Mann's work by studying the engagement and alienation experiences of engineering students. Combining the results of her 2007 study with Mann's 2001 results, she organized Mann's (2001) perspectives into three categories describing different domains of the student learning experience. The first category relates to students' reasons for participating in higher education (termed 'Entering the higher education community'), the second to students' experiences of entry to higher education ('Fitting into the higher education community'), and the third to power relations in assessment practices ('Staying in the higher education community') (Case, 2008). This research links student engagement (or alienation) and satisfaction with the learning environment to retention in engineering programs and provides a useful framework for operationalizing the variables of interest regarding the graduate student experience. With these perspectives in mind, we sought to combine the research on the graduate student experience with the engagement recommendations from undergraduate literature. In the following sections we detail the constructs we developed to measure graduate student satisfaction with their research group experience

2.1 Expectations

Undergraduate engagement literature suggests that high expectations are correlated with positive student engagement (Chickering & Gamson, 1987). At the graduate level, however, the type and nature of student expectations may differ somewhat from undergraduate programs. For this study we considered student and faculty advisor expectations, which include: advisor clarity of expectations for successful progress, whether graduate school was what students expected and the expectation that their graduate experience would prepare students for the career they wanted. Like the undergraduate literature, we hypothesize that students whose expectations have been met, across a variety of levels, are more likely to be satisfied and engaged in their degree programs. A graduate study by Cooke *et al.* (1995), positively related met expectations to degree completion. Similarly, Nerad and Miller (1996) identified frustrated expectations as one of several reasons that students may be dissatisfied with their programs and leave before completion.

2.2 Organization

Organizational climate refers to a set of attributes which can be perceived about a particular organization, and may be induced from the way that organization deals with their members and the environment (Hellriegel & Slocum, 1974). In the graduate literature, climate often refers to the departmental environment in which students are working to complete their graduate degrees (Litzler, Lange, & Brainard, 2005). Negative perceptions about climate can hinder the development of relationships with faculty and peers that students' social and academic integration into graduate school (Litzler, et al., 2005). Undergraduate engagement literature has shown that faculty and peer relationships are positive indicators of student engagement and satisfaction with their programs [NSSE citation]. In Leaving the Ivory Tower, Lovitts (2001) found several levels of interaction relevant to students' satisfaction and persistence in their graduate degree programs, including: peer interactions, students and faculty interactions, and social interactions outside of the research environment.

Organization can encompass a number of factors in graduate literature, notably the ability of faculty advisors to provide sufficient funding for students to complete their degree programs. Golde's work strongly advocates for universities to have intentional structures that support the academic and social integration of doctoral students (Golde, 1998). Along these same lines, Lovitts (2001) concluded that access to resources is a key difference between retained students and those who fail to complete their graduate programs, which may ultimately affect their level of participation, and consequently integration, into the community. In this instrument we focused on items such as the availability of more senior members to ask questions, and frequency (and availability) of advisor or research group meetings, and the availability of consistent funding among others.

2.3 Socialization to the Community

A number of studies have demonstrated that socialization to the community is a strong predictor of doctoral satisfaction and ultimately retention (C. R. Bair & Haworth, 1999; Lovitts, 2001; Mendoza, 2007). Examples include Lovitts (2001) who express socialization in regard to prior anticipatory socialization to the graduate school environment, through culmination of the degree and entrance into the profession. Lovitts considers several reasons students may leave graduate programs, including: the absence of community, and disappointment with the learning experience (Lovitts, 1996, 2001). Learning communities have become increasingly prevalent in undergraduate programs as well. These are communities where students can live or learn or generally have increasing interactions with each other (Zhao & Kuh, 2004). For this study we consider two elements of socialization to the community relevant to graduate students: project ownership and development. Project ownership assesses whether students have taken personal responsibility for their research project. Development attempts to understand the student learning and development which occurs as part of the research group experience.

Although many graduate retention studies focus on the department or degree program as the unit of analysis, research groups are an important aspect of science and engineering graduate training. The vast majority of students entering science and engineering graduate programs will participate in a research group during the course of their program (Alberts, 2009; Altbach, Berdahl, & Gumport, 1999; Deem & Brehony, 2000; Louis, Holdsworth, Anderson, & Campbell, 2007); therefore, attention to the differences inherent in this type of learning environment is critical for understanding engineering student development and ultimately satisfaction and engagement (Cross, 2001). With this in mind, our constructs focus on the research group as the unit of analysis for understanding socialization to community, organization and expectations.

2.4 International Diversity

International Diversity is a construct that was developed to capture how students viewed the highly diverse student population in their research groups. Items in this construct included whether there were multiple nationalities represented in the student's research group and whether they valued this international diversity. We also asked if students experience in their research groups have prepared them to work in international teams and whether they would consider working outside of their home country as a result of their research group experience. Finally we also considered a variety of demographic variables. For this study, our focus was on respondent nationality, however we also considered gender, age, year in program, engineering discipline, and ethnicity (for American students) as part of the instrument, which are discussed in other publications.

3. Methods

In a previous ethnographic study we isolated several constructs of interest that would enable us to better understand the experiences of graduate engineering students; specifically focusing on the issue of satisfaction with the research group experience and intention to complete the graduate degree (Crede & Borrego, in press-a, in press-b, in review). The final constructs from the survey instrument used to examine student satisfaction are shown in Table 1. A detailed description of how these constructs were determined and how they were implemented into specific survey items is discussed elsewhere (Crede & Borrego, in press-a).

Table 1. Constructs used to measure satisfaction with the research group experience

Construct	***Description***
Project Ownership	The extent to which students felt they "owned", or felt responsible for the success of the project they were working on
Expectations	Did students feel they were prepared for graduate school, were their expectations were met, and was their advisor clear in his or her expectations for participation in the research group?
Organization	Items like the presence of more experienced students, availability of resources, research group meetings, advisor meetings, and clear expectations for participation in the group.
International Diversity	The presence of students from multiple countries, the value of international diversity, working in international teams, preparation for the global workplace.
Development	Increasing self confidence, managing a project, teaching oneself new things, speaking up in, preparation for future career.

The dependent variable, satisfaction, was chosen to reflect student self-reported measures of engagement, and to identify where improvements to graduate programs might be made immediately (Gregg, 1972). Demographic items were also included in the instrument to capture variations between and among different student populations; specifically related to nationality. The survey instrument contained a total of 63 questions: 42 Likert-style questions that use a scale from 1 – 5 where 1 is strongly disagree and 5 is strongly agree and 19 demographic and descriptive items. Validity and reliability measures were addressed during instrument development and administration. A draft of the completed instrument was reviewed by both international and domestic students at one institution to address content validity as well as language and question clarity. A pilot test was conducted in the summer of 2010 with a sample of 50 students to determine initial internal consistency metrics. Finally, internal consistency values for each construct from those respondents in the data collection phase ranged from 0.64 to 0.86. For a detailed discussion on the internal consistency or other aspects of the instrument development see Crede and Borrego(in press-a).

3.1 Sample

Table 2 contains a consolidated description of the respondent demographics, including age, gender, nationality and year in program for each university.

Table 2. Demographic Information for Survey Respondents at Participating Institutions

AGE	*24 or Younger*	*25 to 30*	*31 to 35*	*36 or older*	*Total*	
MPUB	**89**	**124**	**9**	**3**	**225**	
EPUB 2	**5**	**24**	**7**	**8**	**44**	
WPRI	**49**	**91**	**14**	**6**	**160**	
EPUB 1	**72**	**107**	**19**	**12**	**210**	
Total	**215**	**346**	**49**	**29**	**639**	
GENDER	***Female***		***Male***		***Total***	
MPUB	**73**		**153**		**226**	
EPUB 2	**18**		**26**		**44**	
WPRI	**43**		**117**		**160**	
EPUB 1	**56**		**154**		**210**	
Total	**190**		**450**		**640**	
NATIONALITY	***U.S***	***Asia***	***China***	***India***	***Middle East***	***Total***
MPUB	**147**	**15**	**31**	**23**	**10**	**226**
EPUB 2	**23**	**3**	**6**	**8**	**4**	**44**
WPRI	**63**	**18**	**37**	**21**	**21**	**160**
EPUB 1	**118**	**15**	**28**	**32**	**17**	**210**
Total	**351**	**51**	**102**	**84**	**52**	**640**
YEAR IN PROGRAM	***First Year***	***Second Year***	***Third Year***	***Fourth Year***	***Fifth or More***	***Total***
MPUB	**48**	**52**	**40**	**44**	**41**	**225**
EPUB 2	**2**	**12**	**7**	**6**	**17**	**44**
WPRI	**51**	**31**	**24**	**26**	**28**	**160**
EPUB 1	**53**	**54**	**41**	**33**	**26**	**207**
Total	**154**	**149**	**112**	**112**	**112**	**639**

The respondents were current engineering doctoral students at four universities purposefully selected based on their 2010 Carnegie classification of RU/VH (research university/very high). The four survey sites included large public (EPUB 1) and small public (EPUB 2) east cost universities, a large public Midwestern university (MPUB) and a large private west coast university (WPRI). The individual respondents in the sample chosen for analysis are all doctoral students, completing their degrees as full time students who are part of a research group. There were more than 40 countries represented by respondents in the sample. These were further grouped into the countries and regions shown in Table 2 to maintain subsample sizes large enough for statistical comparisons. In the Middle East, Iran was the predominant country represented and in Asia respondents primarily hailed from South Korea and Taiwan.

3.2 Survey Administration

Data were collected via online surveys (one version for each institution) administered through email solicitations with a link to the corresponding survey. Of the 1562 students who attempted the survey, 836 of these met the selection criteria of fulltime, on campus graduate students actively participating in a research group, yielding a response rate of 54 percent. Although data was gathered from all levels of graduate students (MS and PhD) we chose to limit the scope of this study to doctoral students only. Of these 836 participants who met the selection criteria, we considered the 640 PhD students whose information is reflected in Tables 2 and 3.

3.3 Data Analysis

In order to characterize the influence of international diversity on satisfaction in doctoral engineering programs we considered variations in responses as a function of the participants' nationality. We used a univariate analysis of variance to compare the means for each construct across the five nationality categories to explore variations within and among respondents from different regional groups (Pedhazur & Schmelkin, 1991). A Tukeys post hoc test was used to explore the specific significant differences between the various nationality regions (Tabachnick & Fidell, 2007). All results were considered significant at the $p < 0.05$ level and Cohens conversion for effect size was used to determine practical significance (J. Cohen, 1988; L. Cohen, Manion, & Morrison, 2000).

4. Univariate ANOVA Results

Overall, students who completed the survey were satisfied with their experiences in their research groups (mean = 3.9). A single analysis of variance analysis comparing the overall means for each of the nationality groups was statistically significant with $p < 0.04$. Students from India had the highest overall satisfaction with their research group experience, while students from China reported the lowest levels. The other three groups, U.S, Middle East and Asia, all feel near the mean, although all three groups responded with below average satisfaction. These results follow closely with previous work, which examined these and other constructs in light of students intent to complete their graduate degree. In previous retention studies, students from China responded well below average for intention to complete their degree (Crede & Borrego, in review). To examine student satisfaction in greater detail, we examined each of the five satisfaction constructs independently as a function of student nationality. These results are shown in Table 3.

Table 3. Univariate ANOVA Table with Effect Sizes

Source of Variation	*Sum of Squares*	*df*	*F-value*	*p-value*	*Effect Size (η^2)*
Development * Nationality	15.922	4	10.907	.000	.064
Expectations * Nationality	7.043	4	5.088	.000	.031
Organization * Nationality	43.445	4	26.963	.000	.145
Project Ownership * Nationality	15.680	4	5.136	.000	.031

All of the nationality groups showed statistically significant differences in the constructs listed in Table 1 with the exception of Organization. To examine practical significance, Cohen (1988) suggests effect sizes for various indexes, including *f* (where 0.1 is a small effect, 0.25 is a medium effect and 0.4 is a large effect). He also offers a conversion table (see Cohen, 1988, p. 283) for eta squared (η^2) where 0.0099 constitutes a small effect, 0.0588 a medium effect and 0.1379 a large effect. Using these effect sizes as a guideline, all of the statistically significant constructs range from small to large practical significance. The largest effect size can be found for international diversity, followed by development and project ownership. To further examine these results, Table 4 shows an expanded view of the comparisons and includes means and standard deviations for each of the constructs and nationality groups.

Table4. Means and Pairwise Comparisons Across Nationality Regions for the Five Satisfaction Constructs

Nationality		*International Diversity*	*Development*	*Project Ownership*	*Organization*	*Expectations*
U.S.	*Mean*	3.55abcd	3.69abc	4.25a	3.65	3.77ba
	N	351	351	350	351	351
	Std. Dev	0.68	0.62	0.83	0.63	0.60
Asia	*Mean*	4.04a	3.86	4.04	3.64	3.84
	N	51	51	51	51	51
	Std. Dev	0.48	0.49	0.92	0.44	0.56
China	*Mean*	3.99b	3.89a	3.90abc	3.74	3.92
	N	102	102	100	102	102
	Std. Dev	0.64	0.65	1.07	0.64	0.61
India	*Mean*	4.12c	4.09b	4.42b	3.85	4.00b
	N	84	84	84	84	84
	Std. Dev	0.58	0.55	0.79	0.60	0.57
Middle East	*Mean*	4.14d	4.07c	4.29c	3.77	4.06a
	N	52	52	52	52	52
	Std. Dev	0.53	0.58	0.85	0.56	0.53
Total	*Mean*	3.78	3.82	4.21	3.70	3.85
	N	640	640	637	640	640
	Std. Dev	0.68	0.62	0.88	0.61	0.60

In addition to the mean and standard deviation data presented in Table 6, individual pairwise comparisons were performed using a Tukey's post hoc test (Montgomery, 2009) and are highlighted for each construct using the superscripts a through d. For example, in the Project Ownership construct, China was significantly different than both the U.S. (a) and the India (b). The results are summarized in this section and expanded to consider specific items as part of the discussion.

For the construct of International Diversity, the U.S (mean = 3.55) was significantly different from all other countries and regions in the study, and was the only group of respondents will below the population average (mean = 3.78). Middle Eastern students respondents reported the highest levels of international diversity (mean = 4.14) followed by students from India (mean = 4.12). There were no other significant differences in the mean responses between any other nations or regional groups. Respondents from the U.S also reported the lowest levels of learning and development (mean = 3.69), compared with the population average of 3.82. Again we see significant differences with all other groups except for respondents from Asia (mean = 3.86). All regions showed high levels of project ownership; students from India indicated the highest agreement with project ownership (mean = 4.42) and Chinese students the lowest (mean = 3.90). These results are highly correlated with reported values for intention to complete the degree program from previous work. As previously discussed there were no significant differences within the Organization construct. Finally, Expectations was the highest for students from the Middle East and India and lowest for students from the U.S and Asia regions.

5. Discussion

When the construct mean for each of the nationality groups was considered, we observed significant differences in four of the five constructs, all of which were also of practical significance. While students from the

U.S and India reported the highest levels of satisfaction with their research group experience, students from the U.S responded the lowest across many of the satisfaction constructs. We will consider each of the constructs in turn to examine variations by respondent nationality.

International Diversity was developed to explore how international diversity manifest within graduate engineering research groups as well as if students developed an appreciation and understanding of other nationalities as a function of working in these teams. This construct included questions such as whether the respondent valued international diversity in their research group, whether they felt their experience in their group, prepared them to work in international teams, or whether their experience made tem consider working outside of their home country. As previously discussed, students from the U.S were the only respondents below the population average, with a slightly positive response (mean = 3.55). One possible explanation for this is that students attending graduate school in the U.S from another country are more acutely aware of the international elements of the experience, while students from the U.S do not view the highly diverse population as an opportunity for this international experience.

Like International Diversity, respondents from the U.S also reported the lowest levels of development compared to their international counterparts. This construct was used as a measure of students learning and growth during the course of their graduate study, and included whether their experiences in their research group increased their self confidence, whether they felt they knew how to manage a project or increased their critical thinking skills among others. Students from India, China, and the Middle East were significantly different from the U.S respondents, and all above the average of 3.82. Development, like Project Ownership, has been shown to be a strong predictor of both student satisfaction as well as intention to complete the degree, and the reasons for these differences based on student nationality should be further explored.

The Project Ownership construct measured student's satisfaction and sense of responsibility towards their current research project; i.e. whether they felt responsible for the success of the project they were working on. Ownership of the projects is one way students might engage in their research groups, and has been shown to be highly correlated to intention to complete the graduate degree (Crede & Borrego, in review). Students from China experienced the lowest levels of project ownership compared to the average (although still positive), while students from India responded very strongly, followed by the Middle East and the U.S.

With respect to student expectations we were interested in whether students felt expectations they held prior to starting their programs were accurate. These included expectations for secure funding for the duration of their program, and their advisors' clarity regarding expectations for satisfactory participation in the research group. We also considered students' expectations upon completing graduate study, such as whether they felt their graduate experience prepared them for their future career. Finally, we asked whether they would make the same decision about attending graduate school if they could go back and do it over again. Students from the Middle East indicated the most positive agreement that their expectations about graduate school were met, followed by students from India, while students from the U.S were the lowest. These results indicate the importance of clear and consistently expressed expectations for all students and at multiple points in their graduate programs.

6. Implications and Future Work

Several studies have identified various differences between engineering and other disciplines, noting that a potential reason was the high representation of international students (Anderson & Lewis, 1994; Gardner, 2009; Nettles & Millett, 2006). This study addresses the limitations and future work described in these and other studies, which have identified international diversity as an increasingly important issue in graduate education in

need of further exploration. The results of this study contribute to the literature on student satisfaction within graduate engineering research groups. Increasing our understanding of factors that contribute to positive student experiences will benefit not only the engineering education community, but all students who work in internationally diverse disciplines. Graduate engineering students trained in collaborative internationally diverse research groups will be better prepared to succeed in an increasingly global marketplace.

Understanding the differences between individual graduate students provides information faculty members and administrators can use to develop an understanding of how each of their individual students is progressing through their programs. The differences shown in this study based on nationality may enable research advisors to develop better sensitivity to cultural differences in students from an internationally diverse student population. These differences have important implications for understanding the cultural differences between different groups of students, and setting ground rules and expectations for all students to follow. Finally, faculty members and administrators can take advantage of the diversity of their groups by encouraging students to share aspects of their culture with the other group members, which will prove valuable to all students in an increasingly diverse international workplace.

In addition to the demographic comparisons mentioned above, future work should include other graduate student populations. Specifically the focus should be on understanding the experiences of students at other types of institutions (not just research intensive based on the Carnegie Classification system). Students from these universities may provide different responses for intention to complete the degree, and other nationality regions, which will yield more detailed insights into actionable changes for these universities. Similarly, these findings could be tested for generalizability to international students in disciplines other than engineering.

Finally the results from this study could be used to inform the development of future studies to understand how the international diversity of graduate students may influence undergraduates' decisions to enroll in graduate programs. Experiences such as interactions with graduate teaching assistants and international faculty and working with graduate researchers on undergraduate research should be explored to understand how these interactions may influence the decision process of undergraduate students

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